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# Characterizing Temperature Variability and Broadband SED Properties of Flares on the M Dwarf Wolf 359 from Simultaneous Multiband Optical Observations

We present a study of flare properties on the highly active M dwarf Wolf 359 using simultaneous multiband ground-based optical observations. High-cadence data were obtained with the instrument TRIPOL on the Lulin 1-m telescope, supplemented by the Lulin 41-cm telescope, over five nights between February 17–22 in 2023. In total, we detected twelve flares. Three flares observed on the first night were captured in the u, g, r, i, and z bands, while the rest were observed in g, r, i, and z bands only. Most flares exhibited significant amplitudes in the u, g, and r bands; only six flares were detectable in the i band, and none in the z band. The most energetic flare released ~$10^{30}$ erg in the g and r bands. Using both three-color SED fitting and two-color ratio methods, we found that most flare peak temperatures in the g band are cooler than the empirical 9000 K, with an average of 6022 ± 1533 K. The hottest flare reached 10,155 K, and the coolest was ~4080 K. Most flares were complex, multi-peaked events, with the hottest moments generally misaligned from the optical brightness peaks. We also investigated the relationship between flare temperature and other parameters. Notably, the u-band amplitudes were brighter than the derived temperatures expected, suggesting a dominant contribution from the Balmer continuum. Additionally, the u-band decay timescale was longer than in g and r, implying differences in cooling mechanisms of heated active regions in the chromosphere and photosphere for this star.

## Section

Stars/Star Clusters

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